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TECHNOLOGY OF AEROGENIC IMMUNIZATION AGAINST SWINE ERYSIPELAS UNDER CONDITIONS OF ACTUAL PRACTICE

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Wright-Patterson Air Force Base, Ohio

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TECHNOLOGY OF AEROGENIC IMMUNIZATION AGAINST SWINE ERYSIPELAS UNDER CONDITIONS OF ACTUAL PRACTICE

H. Möhlmann, Margot Meese, P. Stohr, V. Schultz

Large animal husbandry centers are economical only with high concentration of the herds. The facilities for animal raising must be so protected that infectious diseases do not lead to an endangerment of the herd. In this regard, stringent isolation and prophylactic vaccinations are of importance. The prevention of swine erysipelas infection in large pig-fattening facilities cannot be solved through hygienic measures alone. The animals must be kept under vaccine protection against swine erysipelas, since, in spite of all therapeutic measures, spontaneous outbreaks of swine erysipelas among non-immunized pigs can lead to a considerable loss of animals. The hitherto subcutaneous protective inoculation of large herds however, is time consuming and laborious. Consequently a method must be sought which will immunize large numbers of hogs without syringe and cannula. Needleless methods of inoculation mean less work for all concerned. The methods are suited to intensified swine production and accordingly can be regarded as a suitable further development of the hitherto existing method which individual inoculations make necessary.

In 1968 Meese and his colleagues were able to report on tests with oral and aerogenous erysipelas vaccine. Since that time extensive field tests on approximately 7000 fattening pigs have been carried out in order to test aerogenous erysipelas vaccine. For this purpose shoats in feeding compounds were placed at our disposal. These animals had not previously been immunized against

erysipelas. They had a body weight ranging from 40 to 60 kilograms.

If, however, at the pig production facility the animals, upon the second vaccination against swine fever, have at the same time been immunized against swine erysipelas then this post-immunization strengthens and extends the improved immunity and is recommended by us.

To date, after 20 tests in three different pig-fattening facilities, it can be deduced that, with appropriate technology, the entire herd can be protected against swine erysipelas by means of aerosol application. Moreover we could determine no negative influence of the immunization effects by climatic variables. A well sustained constant immunity was present even in extreme weather conditions such as summer heat, intensive autumn fog conditions and heavy frost.

More particulars on the achievements of the extensive tests will appear in a later issue. The paper will report on the technical accomplishments of our field experiments.

Technical Parts Table

(The part numbers used in the following table correspond to those of Figure 3).

Part Description		Type used in Tests	Price
1	Aerosol Unit	large type, Order No. 3504 Mfr.: VEB Jenaer Glaswerk Schott & Gen. Werk II. Gehlberg Thur.	76.00 M/each
2	Air Compressor	a) Type 40 16 01, TGL 11 534 Kompressorenwerk Air Flow: 32 m^3/h; Compressor Terminal Pressure: 6 kp/cm^2 over-pressure	Approx. 4,500.00 M
		b) Type DiKo Mfr.: VEB Zwickauer Machinenfabrik Air Flow: 150 m^3/h; Compressor Terminal Pressure: 6 kp/cm^2 over-pressure	Approx. 13,400.00 M
3	Air Filter	Type DF 25, TGL 20 736 Mfr.: Reinhard Klinkhardt KG, Wurzen. Max. operating pressure: 10 kp/cm^2 over-pressure	Approx. 150.00 M
4	Pressure Reducing Valve	Pressure Reducing Valve 1, TGL 10 986	Approx. 34.00 M

(Continued)

Technical Parts Table (continued)

Part	Description	Type used in Tests	Price
5	Manometer	Type 1 BM 20, 0-6 kp/cm^2 over-pressure TGL 8701	Approx. 10.00 M
6	Feed Line Tubing	Steam Tubing 13x5 mm. TGL 16 282	Approx. 3.50 M/m
7	Distribution Tubing	Steam Tubing 13x5 mm. TGL 16 282	Approx. 3.50 M/m
8	Tubing Valve	Tubing Valve B 1 TGL 16 660 Bl. 7	Approx. 6.00 M/each
9	Branch Lines	Autogenous Tubing 9 x 3.5 mm.	Approx. 1.50 M/m

(Note: The aerosol units were ordered through the manufacturer. The other items entered in the above table were ordered through the appropriate supplier)

Aerosol Units

The aerosol units used consist of a spherically shaped glass structure, the lower end of which terminates in a support. This connecting pipe is placed beneath a removable floor board. The unit works along the lines of a jet atomizer. The jet portion can be taken out for cleaning and disinfecting. This operation must be done with great caution. In the selection of the unit care must be taken that the ascending tube reaches almost to the bottom of the vessel. In this way the quantity of residual vaccine is kept small (≤ 2 ml). For the atomization of the vaccine (40 to 50 ml) we have applied an operating pressure of 2 kp/cm^2 $\pm$ 0.2 to the apparatus. At these pressures the compressed air consumption amounts to about 5.5 cubic meters per hour. This produces an aerosol particle size distribution having diameters ranging from 0.5 to 20 µm. The aerosol efficiency of the unit - relative to water - is rated at 120 ml/h at the above mentioned operating pressure. Before the utilization of new equipment it is recommended to test its operation and performance with water of the suspension medium, as it is added to the swine erysipelas live vaccine "Dessau" as well as to determine remaining residual quantities after conclusion of the atomization.

Suitable Arrangement of the Aerosol Units Depending on the Type of Stall

Our recommendations are based on the field experiments with three types of sheds. These recommendations, however, lend themselves to other suitable arrangements as may be dictated by existing types of sheds. The number of aerosol units are determined by the size of the shed, the arrangement of the individual stalls in the shed and the number of animals. For all sheds it appears suitable to suspend the aerosol units at a height of 1.50 meters above the shed floor. The separation between two units should not exceed 9 meters.

Shed Type A (a modernization of an older swine-fattening facility).

Five (5) stalls arranged along one side of the passageway with a gutter for dung, a solid dividing wall between stalls, a dunging gutter for each stall and separated one from the other by steel piping construction. Number of animals: 350 to 450.

Shed Dimensions: 44 meters long, 9.60 meters wide, 2.85 meters high (ave. height).

Volume: approximately 1200 m^3.

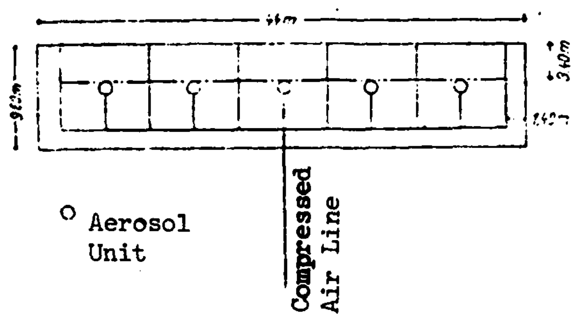

Figure 1. Suitable Arrangement of the Aerosol Units in a Modernization of an Older Swine-Fattening Facility.

In this shed type five aerosol units were used. Each one was suspended above the center of the stall (this includes the floor area of the dunging gutter).

Shed Type B (older swine-fattening facility).

Ten (10) stalls arranged with five to the left and five to the right of the shed passageway, a solid dividing wall (1.10 meters high) between the stalls, the shed passageway bounded by steel piping. Number of animals: 250 to 270.

Shed Dimensions: 47 meters long, 7.50 meters wide, 2.25 meters high.

Volume: approximately 800 m^3.

Sheds of this type (low head room and small volume) make possible the arrangement of the aerosol units over the passageway. Six (6) units were mounted at intervals of eight (8) meters over the middle of the passageway with the first and last unit at a distance of 4 meters from the gable-end.

Shed Type C (modern swine-fattening facility)

Eighteen (18) stalls with dunging gutter consisting of a slatted flooring, the stalls are arranged with nine to the left and nine to the right of the shed passageway, resting area against wall, solid dividing wall for the rest area, dunging gutters separated by steel piping, just so the separation to the passageway. Number of animals: 550 to 650.

Shed Dimensions: 54 meters long, 12 meters wide, 3 meters high.

Volume: approximately 2000 m^3.

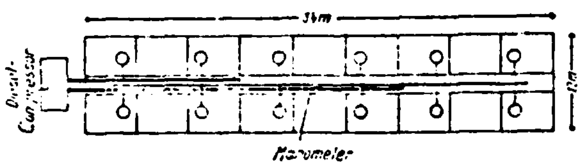

Figure 2. Arrangement of the Aerosol Units in a Modern Swine-Fattening Facility

According to our present test with regard to the stall size one can only achieve adequate immunization results by using a larger number of aerosol units which are placed over

the center of the pen (again the dunging area and the resting area are included). On each side of the shed six aerosol units were installed. They were separated at distances of 9 meters, independent of the pen partitions. On the gable side the distance to the wall was about 4.5 meters. As an experiment, the arrangement of the units over the shed passageway indicated insufficient immunization results.

Compressed Air Supply for Aerosol Units[1]

The operation of the jet aerosol units requires air pressure which must be produced by means of an appropriate unit (air compressor). The required capacity of the air compressor is determined by the air consumption per unit and number of units. Accordingly an air compressor with sufficient capacity must be chosen. The compressor designated under 2a) in the Technical Parts Table is sufficient to operate from 5 to 6 aerosol units at working pressures of 2 kp/cm^2. We mounted the compressor on a small trailer so as to be able to place it into operation with flexibility.

The purchase of a diesel compressor as given in the Technical Parts Table under 2b) is recommended for large shed units. The one used by us sufficed to operate a maximum of 28 aerosol units simultaneously.

A pressure reducing valve 4) must be inserted in the line following the compressor. This valve is for adjustment to

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[1]We extend our sincere gratitude to Engineer Lange for the technical drawings and advise on the description of the compressed air apparatus.

the required working pressure.

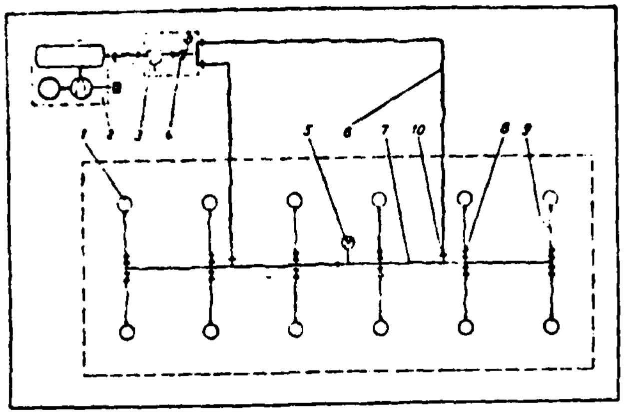

Figure 3. The Compressed Air Supply for Aerosol Units

1. Aerosol Units
2. Air Compressor
3. Air Filter
4. Pressure Reducing Valve
5. Manometer
6. Feed Line Tubing
7. Distribution Tubing
8. Tubing Valves
9. Branch Lines to the Aerosol Units

Upon simultaneous operation of several aerosol units it is recommended that the pressure in the system be adjusted to a somewhat higher level (2.2 to 2.4 kp/cm^2 overpressure) so that the desired operating pressure of 2 kp/cm^2 overpressure actually exist at the units. An additional manometer 5) was built into the distribution line to monitor the pressure.

In the case of an oil-lubricated piston-engine compressor , there will always be a certain amount of oil that will seep past the rings into the compressed air stream. According to the condition of the compressor (wear, maintenance) very small or perhaps very large quantities of this oil will enter the air stream. This leads to contamination of the air lines and the aerosol units and, in the latter case, even to plugging of the jets. In order to avoid this, an airfilter 3) was installed.

A flexible tubing system was necessary in the performance of the field test. It consisted essentially of the feed line tubing 6), the distribution tubing 7), the valves 8) and the branch lines 9) to the aerosol units. Out of weight consideration the branch lines were of autogenous tubing. In this way the aerosol units suspended from chains could be kept from being displaced out of their vertical position.

Other installation material consisted of different T-connectors and reducing sleeves. The use of commercially available compressed air couplings was especially advantageous for fast assembly and disassembly.

In place of a flexible-tubing system, a rigidly mounted arrangement is recommended for use in actual practice. Because the compressed air carries with it some moisture, in spite of the air filter, one should use corrosion resistant material so far as possible.

Before connecting the aerosol units to the vaccine atomizer, the air lines must be purged with compressed air in order to remove possible deposits of dirt and foreign particles and to prevent plugging of the jets.

During the 20- to 30-minute duration of the aerogenic immunization, as well as for a two hour period following its conclusion, certain steps should be taken. Windows, doors, openings and air shafts of the shed should be kept closed. Automatic ventilating systems should be shut off to ensure an even distribution of the aerosol. The animals endure well these measures even in hot summer months. The shed can be briefly entered for taking manometer readings at the distribution line. In doing so, one wears a breathing mask as a safety precaution. A filter having a F 100 mesh is recommended

for the mask. We check the proper operation of all equipment from outside, in general through the windows of the shed. After a work-in time of 2 hours the windows and doors can be opened or the automatic ventilating system can be turned back on, as the case may be. The aerosol units are removed or, as in our case, the feed line tubing system is demounted.

In passing, one might consider the possibility of reducing air-born diseases in the confines of the shed by means of aerosols. The technique discussed in this paper is applicable to this type of control. If the occasion arises, then a treatment of a disease can be carried out with the aid of the aerosol technique.

Groups of swine were immunized against swine erysipelas. They were in sheds with up to 650 fattening places. The immunization was of the type and manner described and with a non-pathogenic live vaccine for humans and animals. It was administered twice in a two week period. This group of swine proved to be immune even during a massive test with swine erysipelas infection which exceeded by far the infectious level normally encountered in practical cases. Consequently the described method has fulfilled the expectations put upon it. Therefore, upon registration by the Central Certification Commission, its application can be recommended for use in actual practice.